

HR-124 Development of a Laboratory Durability Test for Asphalts

Abstract

Research Project HR-124 was initiated in 1966 as a long-range comprehensive program. Its ultimate objective was to develop a simple, rapid laboratory test that could be used by highway engineers to select paving asphalt according to quality, to identify inferior asphalts, and to reasonably predict the useful life of asphalts once they were incorporated in the pavements.

The original proposed study on asphalt durability involved work in the following phases:

1. Critical review of the state of the art on the durability of paving asphalts, the identification of predominant factors causing hardening during mixing, laying, and in-road service.
2. Development of an accelerated laboratory durability test to simulate changes in asphalt both during short-time production and long-term road service.
3. Correlation of hardening and other changes in asphalts during the developed laboratory durability test and changes in same asphalts in pavements.
4. Establishment of durability criteria and functional approach specifications by means of established laboratory durability tests on original asphalt.

Work in phases 1 and 2 was accomplished in the original HR-124 (1966-1967) project and was presented in Progress Report No. 1, paper published in Highway Research Record 231 and a Special Report on the state of the art on asphalt durability.

The first 11 months of field correlation studies in phase 3 were conducted in HR-124 (1967-1969) and were presented in Progress Report No. 2 (October 1968). Progress Report No. 3 summarized the work accomplished during the second year of the HR-124 extension (1967-1969), i.e., the period from 1 October 1968 to 31 October 1969.

In this Final Report, attempts will be made to describe all work conducted under HR-124 up to February 29, 1972, and its implications and recommendations. The overall objectives of HR-124 (1967-1972), which this report covers, were:

1. Refinement of the durability test procedure developed in HR-124 (1966-1967).
2. Durability tests on asphalts used for actual paving projects in Iowa.
3. Determination of changes in asphalts incorporated in the various paving. Projects from the plant and at 6-month intervals thereafter.
4. Field correlations for a period up to 48 months.

CONCLUSIONS AND RECO10ENDATIONS

1. A laboratory durability method (Iowa Durability Test - IDT) for predicting the durability of paving asphalts during mixing and pavement service life has been developed and correlated with field performance under Iowa conditions.
2. The ageing process of paving asphalts follows a hyperbolic function of time both in the field and in the developed IDT laboratory conditions, but at different rates.
3. Good correlations between field service ageing in Iowa and laboratory ageing during Iowa Durability Test have been obtained. The master time-equivalency curve between IDT in hours and pavement service life in months, established by combining all asphalts (void levels) and all properties, indicates that 46 hours in IDT will age asphalts to the equivalent of 60 months in Iowa pavements. Correlation curves for different properties and different levels of pavement voids were also obtained.
4. Laboratory and field performance tests have shown that asphalts meeting current specifications can have various degrees of durability under similar conditions of construction practices, traffic, and climate in the field, and, identical ageing treatments in the laboratory. These observations imply that the current asphalt specification requirements are not sufficiently restrictive to guarantee a durable material.

5. A tentative specification for paving asphalts, including durability requirements based on IDT, is recommended in lieu of current TFOT.
6. To improve the tentative specifications (weaknesses due to lack of sufficient data on critical values of critical properties under Iowa weathering and traffic conditions), continued observations and tests of the eight pavements are recommended. Also recommended is a research project to determine critical property values for Iowa conditions. Such a project can be easily and inexpensively conducted by examining selected 20 to 30 failure asphalt pavements across the State, making certain that failures are not caused by improper design and construction of bases and subbases or other reasons not associated with asphalt quality.